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UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No. 14092
Total Pages in this Submission 4

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11/22/00 JC952 U.S. PTO

TO THE ASSISTANT COMMISSIONER FOR PATENTS
Box Patent Application
Washington, D.C. 20231

Transmitted herewith for filing under 35 U.S.C. 111(a) and 37 C.F.R. 1.53(b) is a new utility patent application for an invention entitled:

RECHARGEABLE ELECTRONIC WATCH AND DRIVING METHOD OF RECHARGEABLE ELECTRONIC WATCH

and invented by:

HISASHI KAWAHARA, et al.

If a CONTINUATION APPLICATION, *check appropriate box and supply the requisite information:*

☐ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: _____

Which is a:

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Which is a:

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Enclosed are:

Application Elements

1. ☒ Filing fee as calculated and transmitted as described below
2. ☒ Specification having 36 pages and including the following:
   a. ☒ Descriptive Title of the Invention
   b. ☐ Cross References to Related Applications *(if applicable)*
   c. ☐ Statement Regarding Federally-sponsored Research/Development *(if applicable)*
   d. ☐ Reference to Microfiche Appendix *(if applicable)*
   e. ☒ Background of the Invention
   f. ☒ Brief Summary of the Invention
   g. ☒ Brief Description of the Drawings *(if drawings filed)*
   h. ☒ Detailed Description
   i. ☒ Claim(s) as Classified Below
   j. ☒ Abstract of the Disclosure

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Application Elements (Continued)

3. ☒ Drawing(s) *(when necessary as prescribed by 35 USC 113)*
   a. ☒ Formal Number of Sheets 7
   b. ☐ Informal Number of Sheets

4. ☒ Oath or Declaration
   a. ☒ Newly executed *(original or copy)* ☐ Unexecuted
   b. ☐ Copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional application only)*
   c. ☒ With Power of Attorney ☐ Without Power of Attorney
   d. ☐ *DELETION OF INVENTOR(S)*
   Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. 1.63(d)(2) and 1.33(b).

5. ☐ Incorporation By Reference *(usable if Box 4b is checked)*
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

6. ☐ Computer Program in Microfiche *(Appendix)*

7. ☐ Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all must be included)*
   a. ☐ Paper Copy
   b. ☐ Computer Readable Copy *(identical to computer copy)*
   c. ☐ Statement Verifying Identical Paper and Computer Readable Copy

Accompanying Application Parts

8. ☒ Assignment Papers *(cover sheet & document(s))*

9. ☐ 37 CFR 3.73(B) Statement *(when there is an assignee)*

10. ☐ English Translation Document *(if applicable)*

11. ☐ Information Disclosure Statement/PTO-1449 ☐ Copies of IDS Citations

12. ☐ Preliminary Amendment

13. ☒ Acknowledgment postcard

14. ☒ Certificate of Mailing

☐ First Class ☒ Express Mail *(Specify Label No.):* EL-658-969-404-US

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Accompanying Application Parts (Continued)

15. ☒ Certified Copy of Priority Document(s) *(if foreign priority is claimed)*

16. ☐ Additional Enclosures *(please identify below):*

Request That Application Not Be Published Pursuant To 35 U.S.C. 122(b)(2)

17. ☐ Pursuant to 35 U.S.C. 122(b)(2), Applicant hereby requests that this patent application not be published pursuant to 35 U.S.C. 122(b)(1). Applicant hereby certifies that the invention disclosed in this application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication of applications 18 months after filing of the application.

Warning

An applicant who makes a request not to publish, but who subsequently files in a foreign country or under a multilateral international agreement specified in 35 U.S.C. 122(b)(2)(B)(i), must notify the Director of such filing not later than 45 days after the date of the filing of such foreign or international application. A failure of the applicant to provide such notice within the prescribed period shall result in the application being regarded as abandoned, unless it is shown to the satisfaction of the Director that the delay in submitting the notice was unintentional.

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Fee Calculation and Transmittal

CLAIMS AS FILED

For	#Filed	#Allowed	#Extra	Rate	Fee
Total Claims	80	- 20 =	60	x $18.00	$1,080.00
Indep. Claims	14	- 3 =	11	x $80.00	$880.00
Multiple Dependent Claims (check if applicable) ☐					$0.00
				BASIC FEE	$710.00
OTHER FEE *(specify purpose)*					$0.00
				TOTAL FILING FEE	$2,670.00

☒ A check in the amount of **$2,670.00** to cover the filing fee is enclosed.

☒ The Commissioner is hereby authorized to charge and credit Deposit Account No. **19-1013 SSMP** as described below. A duplicate copy of this sheet is enclosed.

- ☐ Charge the amount of as filing fee.
- ☒ Credit any overpayment.
- ☒ Charge any additional filing fees required under 37 C.F.R. 1.16 and 1.17.
- ☐ Charge the issue fee set in 37 C.F.R. 1.18 at the mailing of the Notice of Allowance, pursuant to 37 C.F.R. 1.311(b).

Signature

Dated: **November 22, 2000**

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SPECIFICATION

RECHARGEABLE ELECTRONIC WATCH AND DRIVING METHOD OF RECHARGEABLE ELECTRONIC WATCH

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention related to a rechargeable electronic watch and a driving method of the rechargeable electronic watch, and more particularly, a rechargeable electronic watch of which clock operation duration can be prolonged and a driving method of the same.

2. Description of the Related Art

Conventionally, some electronic watches are provided with an additional power saving mode function for reducing the power consumption of the electronic watch provided that it would not hinder particularly the use of the electronic watch, for the purpose of using as long as possible the power supply means composed of battery or a storage battery or the like used at the same time as a power generation means.

For instance, as disclosed in the Japanese Unexamined Patent Publication (KOKAI) No. 5-60075, an electronic watch using a solar cell as main battery composed to enter the power save mode when there is no sunlight incident to the solar cell of the electronic watch for a predetermined fixed time continuously, and to release the power saving mode when there will be sunlight incident to the solar cell again is known.

By the way, the power saving mode function in such a conventional electronic watch is composed to enter the power saving mode for stopping all hour display and stop driving the display means including hour information display in a state disadvantageous for the power source, for instance, when a solar cell is used as power source, because it is primordial to use the power source as long as possible.

However, in recent years, an analog electronic watch whose time and minute hands and second hand are driven by separate motors for hour display, or

a combination electronic watch wherein the second is displayed by liquid crystal display are also made for practical use, and if all hour display is stopped under a certain condition, the user could not obtain any information at all.

On the other hand, electronic watches provided with a built-in display mechanism of several kinds of functions including chronometer display function, alarm display function, atmospheric pressure display function, water depth display function or the like are also made for practical use, and are composed to display on a predetermined display means the kind or kinds of function information at the same time as the hour information, or changing over with the hour information.

In such resent electronic watches implementing function information other than hour information, if a conventional type power saving mode function is used, not only the hour information but also function information are not displayed at the same time on the display means, when a state disadvantageous for the power source as mentioned above happens, blocking the use of the function information display means, particularly in an environment requiring function information, causing to reduce the product value as multi-functional electronic watch.

On the other hand, the Japanese Unexamined Patent Publication (KOKAI) No. 9-304555 discloses a rechargeable electronic watch wherein a counter is installed for measuring the lap time after the motor stop, to facilitate to return to an accurate actual hour even when the hand motion is stopped for power saving, and for measuring rapid advance time also, to return time and minute hands to the accurate actual time from both measured times.

However, in the Publication, the motion of the time and minute hands stops only when the output from the power generation means or power storage means of the rechargeable electronic watch becomes equal or inferior to a predetermined level, namely, only under a certain fixed condition; therefore, in a rechargeable electronic watch provided with a plurality of additional

functions, the additional functions become completely unavailable, event when the voltage state allows to used the additional functions, causing the user inconvenience.

SUMMARY OF THE INVENTION

Therefore, the object of the present invention is to improve the aforementioned defects of the prior art and to provide an electronic watch in that in displaying clock information and function information on separated display means, respectively, for example, by hands and a liquid crystal display, the electronic watch can be selectively controlled under the most optimal clock operation mode selected from a plurality of clock operation modes by selecting arbitrary circuit or by using a display means whereby the display means can be stopped in response to an amount of power generation in a power generator or an amount of charge stored in a power storing means as a power saving mode.

Further object of the present invention is to provide a rechargeable electronic watch among multi-functional rechargeable electronic watches providing a number of additional function information, which cannot loose usage feeling of the rechargeable electronic watch by forming the electronic watch so that one of functions of the rechargeable electronic watch can be selected arbitrarily in response to either an amount of power generation in a power generator or an amount of charge stored in a power storing means so as to optimize a balance of the power, which is the same as that in an electronic watch only displaying time information, whereby it is intended to extend a clock operation duration of the rechargeable electronic watch as well as to keep limitations for using a certain function a user of the watch wishes to use at the most necessary lowest level.

In order to attain the above-mentioned objects of the present invention, the present invention basically has the technical construction as mentioned hereunder.

Note that, a first aspect of the present invention is a rechargeable

electronic watch operating with an energy source comprising a power supply including a power generation means and a power storage means charged with electric energy generated from the power generation means, the rechargeable electronic watch comprising a watch circuit for counting or processing time information or function information or the like so as to outputting the information, a display means for displaying the time information or the function information or the like based on an output signal from the watch circuit, a power generation amount detecting means for detecting an amount of the power generation of the power generation means, and a control means for controlling the operation of the watch circuit in response to the amount of the power generation , wherein the watch circuit is driven in at least one clock operation mode selected, based on the control of the control means, from a plurality of clock operation modes provided in the rechargeable electronic watch, each of the modes being different from each other in power consumption.

A second aspect of the present invention is a rechargeable electronic watch operating with an energy source comprising a power supply including a power generation means and a power storage means charged with electric energy generated from the power generation means, the rechargeable electronic watch comprising a watch circuit for counting or processing time information or function information or the like so as to outputting the information, a display means for displaying the time information or the function information or the like based on an output signal from the watch circuit, a charge amount detecting means for detecting an amount of charge stored in the power storage means, and a control means for controlling the operation of the watch circuit in response to the amount of the charge, wherein the watch circuit is driven in at least one clock operation mode selected, based on the control of the control means, from a plurality of clock operation modes provided in the rechargeable electronic watch, each of the modes being different from each other in power consumption.

A third aspect of the present invention is a rechargeable electronic watch operating with an energy source comprising a power supply including a power generation means and a power storage means charged with electric energy generated from the power generation means, the rechargeable electronic watch comprising a watch circuit for counting or processing time information or function information or the like so as to outputting the information, a display means for displaying the time information or the function information or the like based on an output signal from the watch circuit, a power generation amount detecting means for detecting an amount of the power generation of the power generation means, a charge amount detecting means for detecting an amount of charge stored in the power storage means, a remaining capacity detecting means for detecting the remaining capacity of the power storage means and a control means for controlling the operation of the watch circuit in response to the optional two detected values selected among three detected values such as the power generation amount, the charge amount and the remaining capacity, wherein the watch circuit is driven in at least one clock operation mode selected, based on the control of the control means, from a plurality of clock operation modes provided in the rechargeable electronic watch, each of the modes being different from each other in power consumption.

BRIEF DESCRIPTION OF THE DRAWING

Fig. 1 is a block diagram showing the composition of one concrete example of the rechargeable electronic watch of the present invention;

Fig. 2 is a block diagram showing the composition of a first concrete example of the rechargeable electronic watch of the present invention;

Fig. 3 is a block diagram showing the composition of a second concrete example of the rechargeable electronic watch of the present invention;

Fig. 4 is a block diagram showing the composition of a fourth concrete example of the rechargeable electronic watch of the present invention; and

Fig. 5 is a block diagram showing the composition of a fifth concrete example of the rechargeable electronic watch of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Now, specific examples of rechargeable electronic watch and driving method of rechargeable electronic watch of the present invention will be described in detail referring to drawings.

Namely, Fig. 1 is a block diagram illustrating the composition of one concrete example of a rechargeable electronic watch 10 according to the present invention, and in the drawing, a rechargeable electronic watch 10 operating with an energy source comprising a power supply 26 including a power generation means 1 and a power storage means 2 charged with electric energy from the power generation means 1, the rechargeable electronic watch 10 comprising a watch circuit 5 for counting or processing time information or function information or the like and outputting information, a display means 11 for displaying time information or function information or the like based on output signal from the watch circuit, an amount of power generation detecting means 3 for detecting the power generation amount of the power generation means 1, and a control means 4 for controlling the operation of the watch circuit 5 in response to the power generation amount, wherein said watch circuit 5 is driven in at least one clock operation mode selected, based on the control of said control means, from a plurality of clock operation modes provided in said rechargeable electronic watch, each of the modes being different from each other in power consumption.

In other words, Fig. 1 is a block diagram showing the outline composition of essential parts of the rechargeable electronic watch 10 according to the present invention, and the power generation means 1 composing the power supply 26 is not particularly limited in its composition, but it may be a solar cell, self-winding type power generator for generating power in response to the motion, including arm motion, thermal power generator for generating power using

differential temperature, or those using spring drive power generation or the like.

In addition, the power storage means in the present invention is not particularly limited in its composition; however, for instance, a rechargeable secondary battery can be employed.

On the other hand, besides the means 30 for detecting the amount of the power generation of the power generation means, the power generation amount detecting means 3 may be composed to include a power storage amount detecting means 31 for detecting the power storage amount to the accumulation means 2.

The power generation amount detecting means 3 of the present invention can be realized by composing to detect, for instance, voltage or current output from the power generation means 1 or the power storage means 2, even in case of detecting an amount of the power generation, or in case of detecting an amount of the power storage.

Next, the control means used in the present invention has a function to select a clock operation mode which being the most appropriate for the concerned object, with taking the conditions of power generation amount of the power generation means 1 detected by the aforementioned power generation amount detecting means 3 or the amount of the remaining capacity stored in the power storage means 2 into the account, a processing is performed by determining whether or not the degree of the power generation amount of the power generation means 1 or the remaining capacity stored in the power storage means 2 at the current period, is a sufficient level for operating all of the plurality of the clock operation modes provided on the electronic watch circuit 5 or by determining which clock operation mode would be prefer to be selected or which clock operation mode would be prefer to be stopped taking the power consumption of each one of the clock operation modes into the account so as to keep the remaining capacity of the power storage means for a long time as possible it can.

The control means 4 has a data master or lookup table 70 for memorizing individually the power consumption amount in each of the aforementioned several kinds of clock operation modes, selects and controls the optimal state from several kinds of clock operation modes based on the information from the lookup table 70 and power generation amount detecting means 3.

On the other hand, the watch circuit 5 used in the present invention is composed to operate supplied with power from the power supply 26, and includes a time circuit 6 for outputting hour information and a clock operation mode setting means 40 for executing various clock operation modes.

The clock operation mode setting means 40 of the present invention includes preferably at least one of driving operation modes such as, for example, second hand driving operation mode for driving the second hand, namely second hand driving operation mode setting means 7, minute and hour hands driving operation mode for driving the minute and hour hands, namely minute and hour hands driving operation mode setting means 8, liquid crystal display means driving operation mode setting means 9, and further, alarm function driving operation mode setting means 12, chronometric function driving operation mode setting means 13, water depth measuring function driving operation mode setting means 14, temperature measuring function driving operation mode setting means 15, altitude measuring function driving operation mode setting means 16, atmospheric pressure measuring function driving operation mode setting means 17, radio reception function driving operation mode setting means 18, calendar display function driving operation mode setting means 19 or the like.

For the aforementioned respective clock operation mode, the power consumption required for executing its driving operation mode respectively each other, is sometimes identical, but different in general; therefore, electric energy consumption in the power supply 26 becomes different, by which and how many of several kinds of clock operation modes, namely clock operation modes are to be selected.

Consequently, when the power generation amount, or remaining capacity in the power supply 26 is sufficient, all of respective clock operations modes installed the rechargeable electronic watch 10 mentioned above may well be driven; however, when the power generation amount, or remaining capacity in the power supply 26 is low, it is composed to execute the selection operation to drive only the minimum required clock operation mode based on the power generation amount or remaining capacity of the power generation means at the actual point of time so as not to deteriorate the feeling of use of the user of the rechargeable electronic watch 10 provided with additional functions, by maintaining the remaining capacity in the power supply 26.

As the power consumption during the driving in the aforementioned respective driving operation mode can be predetermined, it is preferable to composed to store that information in a convenient data base, or memorize in a predetermined format lookup table, and allow the control means 4 to refer to the data base or lookup table.

The display means 11 of the present invention may be composed of any of digital display mechanism or analog display mechanism, and for instance, if the display means 11 adopts the analog display system, a second hand 20 as second display apparatus and hour and a minute hand 21 as hour and minute display apparatus are provided, and at the same time, the second hand driving operation mode setting means 7 and hour and minute hand driving operation mode setting means 8 are connected to a second hand motor driving circuit 50 and a hour and minute motor driving circuit 51 respectively.

Besides, in the display means 11 of the present invention, if both the second display apparatus 20 and the hour and minute display apparatus 21 adopt a digital display data composed of a digital circuit, the both apparatuses result in using a crystal liquid display means, and in this case, second hand motor driving circuit 50 and hour and minute motor driving circuit 51 become unnecessary.

In addition, if calendar function is to be used, or the other measurement results are to be displayed, they can be displayed by the crystal liquid display means 22, and in this case, the liquid crystal display means 22 is preferably driven through a convenient crystal liquid driving control circuit 52.

Similarly, in the present invention, if alarm function or chronometric function are adopted, a digital display apparatus is preferably used as the display means corresponding to respective function, an analog display apparatus may also be used.

As for the display means when the alarm function is to be executed, sound, or light, vibration or other reporting means can be adopted, and sound report means 23, optical report means 24 or vibration report means 25 or the like for this effect can be installed in the display means 11.

In the rechargeable electronic watch 10 of the present invention, it may also be composed to receive radio electric wave containing hour information, and in this case, it is operate to make the time circuit agree with the hour information of the received electric wave, by driving a reception circuit provided in the rechargeable electronic watch 10, at a predetermined timing, and it goes without saying that the power consumption at that time is also controlled by the present invention.

In such case, it is useless to provide especially the display means 11 with a specific display circuit; however, the reception state of radio signal containing hour information may be displayed by an optical display means 24 or the like.

Now the operation algorithm of the control means 4 used in the present invention will be described.

Note that, the control object of the control means 4 in the present invention is to select a clock operation mode for achieving the required power

saving operation mode, with determining an amount of the power generation of the power generating means 1 or the remaining capacity of the power storage means 2, both of which consisting the power supply 26 of the rechargeable electronic watch 10 and by processing to realize how the power supply 26 can be kept in effective for a long time or to realize a power saving mode by considering which kind of clock operation mode among a plurality of clock operation modes provided in the rechargeable electronic watch 10, should be selected so as to reduce the power consumption of the rechargeable electronic watch 10, in order to display the necessary function information even when the amount of the power generation or the amount of the remaining capacity of the power supply 26 has been reduced.

For instance, the control means 4 detects automatically the condition in which the remaining capacity of the power storage means 2 has become equal to or lower than the predetermined threshold value, or the amount of the power generation of the the power generation means 1 in the power supply 26 has become equal to or lower than the predetermined threshold value, or an amount of the sunlight incident to the solar power generator is equal to or lower than the predetermined threshold value continuously for a predetermined period of time, when the power generation means 1 is a solar power generator, and performs the operation processing to select a clock operation mode allowing to obtain the most appropriate power saving state in terms of power consumption, among several kinds of clock operations states of the rechargeable electronic watch 10.

Consequently, if the power generation amount of the power generation means 1 in the power supply 26 is sufficient, or the remaining capacity of the power storage means 2 in the power supply 26 is sufficient, all clock operation modes loaded previously on the rechargeable electronic watch 10 can be driven, and such a state is one of clock operation modes of the present invention.

Besides, if the power generation amount of the power generation means 1 or the remaining capacity of the power storage means 2 in the power supply 26 has become slightly lower than that the predetermined threshold, it is possible to execute such a control to set several kinds of clock operation modes under which a driving operation of at least one clock operation mode having a low power consumption, selected from all clock operation modes loaded previously on the rechargeable electronic watch 10, is stopped or on the contrary, it is also possible to control so as to stop driving operation of at least one clock operation mode having large power consumption, among all clock operation modes loaded previously on the rechargeable electronic watch 10.

Similarly, if the power generation amount of the power generation means 1 or the remaining capacity of the power storage means 2 in the power supply 26 has become considerably lower that the predetermined threshold, for example, it is possible to execute such a control to set several kinds of clock operation modes, to stop a plurality of driving operations among a plurality of driving operations different in their power consumption, among all clock operation modes loaded previously on the rechargeable electronic watch 10.

Further, in the present invention, it is also possible to execute such a control to set a clock operation mode allowing a condition under which the power supply 26 can be used as long as possible, or allowing a condition under which a predetermined necessary function can be driven regardless the current situation of the power generation amount of the power generating means 1 or of the remaining capacity of the power storage means 2, by detecting how extent the amount of the power generation of the power generating means 1 or the amount of remaining capacity of the power storage means 2, both of which consisting the power supply 26, has been reduced from the predetermined threshold and taking the present situation of the amount of the power generation of the power generating means 1 or the amount of remaining capacity of the power storage means 2, into account.

The control method in the present invention mentioned above may be the one composed to process the operation automatically, according to a predetermined program, or particularly, as for the operation concerning the additional function, it is possible to modify the clock operation mode, so that the power saving operation mode be set, by the manual operation of the user.

In the present invention, even if any driving means of the display means 11 and the watch circuit 5 of the rechargeable electronic watch 10 is in the power saving operation mode, the predetermined display information is certainly erased from the display means; however, it is composed to allow the hour information in the rechargeable electronic watch 10 to display the actual hour immediately, when the power saving operation mode is cancelled, as the time circuit 6 runs always normally, and its state is always memorized in a predetermined memory.

For example, at the same time as composing to count the time during the hour display suspension by providing a convenient counter, the resume of the hour display can be realized by providing a fast-forward means, to fast forward the hour and minute hands to the actual hour.

The first concrete example of the present invention, in the block diagram of Fig. 2, is composed to control the control means 4 according to the power generation amount of the power generation means 1 sensed by the power generation amount detecting means 30 for detecting the power generation amount of the power generation means 1, and now, a concrete example of the driving method of the rechargeable electronic watch 10 of the present invention will be described referring to Table 1.

In other words, in this concrete example, the display means 11 of the rechargeable electronic watch 10 is supposes to comprise a second display apparatus 20, an hour and minute display apparatus 21 and a calendar display apparatus 22, and a second hand motor driving control circuit 50, a hour and minute motor driving control circuit 51 and a calendar display apparatus driving

control circuit 52 or the like are disposed between the watch circuit 5 and the display means 11.

Also, it is supposed that, in the display means 11, the power consumption of the calendar display apparatus 22 is the largest, then the power consumption of the second display apparatus 20 is second largest, and the power consumption of the hour and minute display apparatus 21 is lowest among the aforementioned three kinds of display apparatuses.

In such a situation, the display means 11 is controlled to one of several levels of clock operation mode according to the case where the power generation amount of the power generation means 1 sensed by the power generation amount detecting means 3 is equal or lower than the predetermined threshold value, and the power generation amount is equal or superior to the threshold, and further the degree of the power generation amount.

In this concrete example, for example, as it is obvious from Table 1, the second hand motor driving control circuit 50, hour and minute motor driving control circuit 51 and calendar display apparatus driving control circuit 52 are activated respectively by a control signal Ea for controlling the liquid crystal display driving apparatus driving the calendar display means, a control signal Eb for controlling the driving of the second display apparatus, and a control signal Ec for controlling the driving of the hour and minute second display apparatus output according to the sensed power generation amount from the power generation amount detecting means 3.

In the Table 1, the control signal H indicate the active state.

In other words, if the power generation amount of the power generation means 1 is equal or lower than the predetermined threshold value, all control signals Ea, Eb, Ec are set to "L" level to stop the display operation of the aforementioned three kinds of display apparatuses.

Even in such state, the time circuit 6 of the watch circuit 5 is driven normally.

Next, even when the power generation amount of the power generation means 1 is equal or superior to the predetermined threshold value, if its power generation amount is low, only the hour and minute display apparatus 21 of which power consumption is the lowest is driven, among the aforementioned three kinds of display apparatuses, while the driving of the other display apparatuses 20, 22 is set to stop.

On the other hand, when the power generation amount of the power generation means 1 is equal or superior to the predetermined threshold value and its power generation amount is relatively high, the hour and minute display apparatus 21 of which power consumption is the lowest and the second display apparatus 20 requiring next lowest power consumption are driven, among the aforementioned three kinds of display apparatuses, while the driving of the calendar display apparatuses 22 is set to stop.

Further, when the power generation amount of the power generation means 1 is equal or superior to the predetermined threshold value and its power generation amount is considerably high, it is controlled to drive all of the aforementioned three kinds of display apparatuses.

This concrete example adopts an algorithm to drive the display apparatuses beginning from the one lowest in power consumption, in response to the increasing degree of the power generation amount of the power generation means 1; however, this order can be modified, and in addition, as mentioned below, it is also possible to compose to stop intentionally a predetermined display apparatus and to drive a predetermined display apparatus by the user setting.

Now, a second concrete example of rechargeable electronic watch and driving method of rechargeable electronic watch of the present invention will be described in detail referring to Fig. 3 and Table 2.

In other words, in this concrete example, compared to the aforementioned first example, the detecting means is provided with a power generation amount

detecting means 3 for detecting the power generation amount of the power generation means 1 and a power storage amount detecting means 31 for detecting the power storage amount to the accumulation means 2 or a remaining capacity detecting means 32, and it is composed to determine the clock operation mode, namely clock operation mode, based on both detecting information.

Namely, this concrete example is composed to select on operation mode mode modifying the combination of display apparatus to be operated respectively, according to the magnitude of the power generation amount and the magnitude of the remaining capacity.

There, the composition of the rechargeable electronic watch 10 in this concrete example is supposed to be similar to the composition shown in Fig. 2 except that the power storage amount detecting means 31 or the remaining capacity detecting means 32 are added, the second hand motor driving control circuit 50, hour and minute motor driving control circuit 51 and calendar display apparatus driving control circuit 52 are activated respectively by a control signal Ea (liquid crystal display), a control signal Eb (second display), and a control signal Ec (hour and minute second display) from a power generation amount detecting means 30; however, at the same time, it is controlled to select one of clock operation modes setting selectively the second hand motor driving control circuit 50, hour and minute motor driving control circuit 51 and calendar display apparatus driving control circuit 52 to activated state or non activated state respectively, as shown in Table 2, by limiting the control signal from the power generation amount detecting means 30 by means of a control signal Ma controlling the liquid crystal display driving apparatus driving the calendar display means, a control signal Mb for controlling the driving of the second display apparatus, and a control signal Mc for controlling the driving of the hour and minute second display apparatus, output from a remaining capacity detecting means 32.

In other word, in this concrete example, a rechargeable electronic watch

10 operating with an energy source comprising a power supply 26 including a power generation means 1 and a power storage means 2 charged with electric energy from the power generation means 1, the rechargeable electronic watch 10 comprising a watch circuit 5 for counting or operating hour information or function information or the like and outputting information, a display means 11 for displaying hour information or function information or the like based on output signal from the watch circuit 5, a power generation amount detecting means 30 for detecting the power generation amount of the power generation means 1, a remaining capacity detecting means 32 for detecting the remaining capacity of the power storage means 2 and a control means 4 for controlling the operation of the watch circuit 5 according to the remaining capacity and the power generation amount, wherein the watch circuit is driven by at least one clock operation mode selected from a plurality of clock operation modes different in power consumption provided by the watch circuit 5 based on the control of the control means 5, can be obtained.

In the third concrete example of the present invention, it is also possible to compose to control the control means 4, according to the power generation amount of the power generation means 1 sensed by the power generation amount detecting means 30 and the remaining capacity of the power storage means 2 sensed by the remaining capacity detecting means 31, in the block diagram of Fig. 1.

On the other hand, the fourth concrete example of the present invention is, as shown in Fig. 4, a rechargeable electronic watch 10 operating with an energy source comprising a power supply 26 including a power generation means 1 and a power storage means 2 charged with electric energy from the power generation means 1, the rechargeable electronic watch comprising a watch circuit 5 for counting or operating hour information or function information or the like and outputting information, a display means 11 for displaying hour information or function information or the like based on output signal from the

watch circuit 5, a power storage amount detecting means 31 for detecting the power storage amount of the power storage means 2, a remaining capacity detecting means 32 for detecting the remaining capacity of the power storage means 2 and a control means 4 for controlling the operation of the watch circuit 5 according to the remaining capacity and the power generation amount, wherein the watch circuit is driven by at least one clock operation mode selected from a plurality of clock operation modes different in power consumption provided by the watch circuit 5 based on the control of the control means 5.

On the other hand, as an example of control algorithm in the control means 4 in the present invention, for example, it may composed to drive in a clock operation mode of low power consumption, among a plurality of clock operation modes different in power consumption, the lower is the power generation amount of the power generation means 1, or to control to drive in a clock operation mode of low power consumption, among a plurality of clock operation modes different in power consumption, the lower is the power storage amount of the power storage means 2.

Moreover, in the present invention, it is also possible to control to drive in a clock operation mode of low power consumption, among a plurality of clock operation modes different in power consumption, the lower is the remaining capacity of the power storage means 2.

Now, a fifth concrete example of the rechargeable electronic watch 10 according to the present invention will be described in detail referring to Fig. 5 and Table 3.

While, in the aforementioned respective examples, it is composed to select one of clock operation modes of putting some or all of respective display apparatuses in the display means 11 in driving state or putting all of respective display apparatuses in non driving state, according to a predetermined algorithm, based on output information from respective detecting means of power generation amount detecting means 30, power storage amount

detecting means 31 or remaining capacity detecting means 32, or the like; however, in this concrete example, the rechargeable electronic watch 10 is further provided with an user setting means 80 allowing the user to set the clock operation mode, and the control means 4 it is composed to drive the watch circuit 5 in a clock operation mode desired by the user, based on the output signal from the user setting means 80, namely, a signal showing that the user has set consciously a predetermined power saving function.

Consequently, the block diagram of this concrete example is substantially similar to Fig. 3, and has a composition in which the remaining capacity detecting means 32 of Fig. 3 is substituted with the user setting means 80.

In such composition, the second hand motor driving control circuit 50, hour and minute motor driving control circuit 51 and calendar display apparatus driving control circuit 52 are activated respectively by control signals Ea (liquid crystal display) Eb (second display) Ec (hour and minute second display) from the power generation amount detecting means 30; however, the control signal from the power generation amount detecting means 30 is limited by means of control signals Sa (liquid crystal display) Sb (second display) Sc (hour and minute second display) for power saving function setting selected and controlled by the operation setting of the user through the user setting means 80.

The operation signal by the user setting means 80 is, for example, set to (1) always execute all displays; (2) limit only the liquid crystal display according to the power generation amount; (3) limit the liquid crystal and second display according to the power generation amount; and (4) limit the liquid crystal, second display, hour and minute display according to the power generation amount.

Control signals and operation modes according to the power generation amount and the user setting are as shown Table 3.

The present invention intends, basically, to extend the use period of time of the rechargeable electronic watch as long as possible without affecting the feeling of use of the user, by controlling so that the energy balance of the power generation amount in the power generation means 1 minus the energy consumption by the display means 11 would not be negative and, for this effect, it is also necessary to control the energy balance.

In other words, in the present invention, a rechargeable electronic watch operating with an energy source comprising a power supply including a power generation means and a power storage means charged with electric energy from the power generation means, the rechargeable electronic watch comprising a watch circuit for counting or operating hour information or function information or the like and outputting information, a display means for displaying hour information or function information or the like based on output signal from the watch circuit, a power generation amount detecting means for detecting the power generation amount of the power generation means, and a control means for controlling the operation of the watch circuit according to the energy balance of the power generation amount and the clock power consumption amount, wherein the watch circuit is driven by at least one clock operation mode selected from a plurality of clock operation modes different in power consumption provided by the watch circuit based on the control of the control means is also one of concrete examples.

Here, in the rechargeable electronic watch 10 of the concrete example according to the invention shown in Fig. 2 to Fig. 5, supposing that power generation amount of the power generation means 1, namely, current generated by the power generation means 1 is IG, current consumption by driving the liquid crystal display means 22 Ia, current consumption by driving the second display motor of the second display means 20 Ib, current consumption by driving the hour and minute display motor of the hour and minute display means 21 Ic, and current consumption by oscillator, counter circuit or the like other than the

respective display apparatuses in the watch circuit 5 Iz, the operation mode control based on the energy balance corresponding to the magnitude of the power generation amount and the magnitude of the power consumption of respective apparatus gives a relation as shown in Table 4.

In the aforementioned Table 4, if a system is composed to permit to select the state marked with *1, the balance will not be negative even when the power generation is minimum (or null), but the time will be wrong.

In the concrete example according to the invention, it is also possible to compose a rechargeable electronic watch operating with an energy source comprising a power supply including a power generation means and a power storage means charged with electric energy from the power generation means, the rechargeable electronic watch comprising a watch circuit for counting or operating hour information or function information or the like and outputting information, a display means for displaying hour information or function information or the like based on output signal from the watch circuit, a power storage amount detecting means for detecting the power storage amount of the power storage means, and a control means for controlling the operation of the watch circuit according to the energy balance of the power storage amount and the power consumption amount of the rechargeable electronic watch, wherein the watch circuit is driven by at least one clock operation mode selected from a plurality of clock operation modes different in power consumption provided by the watch circuit based on the control of the control means, and moreover, it is also possible to compose a rechargeable electronic watch operating with an energy source comprising a power supply including a power generation means and a power storage means charged with electric energy from the power generation means, the rechargeable electronic watch comprising a watch circuit for counting or operating hour information or function information or the like and outputting information, a display means for displaying hour information or function information or the like based on output signal from the watch circuit,

a power generation amount detecting means for detecting the power generation amount of the power generation means, a remaining capacity detecting means for detecting the remaining capacity of the accumulation means and a control means for controlling the operation of the watch circuit according to the energy balance of the remaining capacity, the power generation amount and the power consumption amount of the clock, wherein the watch circuit is driven by at least one clock operation mode selected from a plurality of clock operation modes different in power consumption provided by the watch circuit based on the control of the control means.

Further, it is possible to compose a rechargeable electronic watch 10 operating with an energy source comprising a power supply including a power generation means and a power storage means charged with electric energy from the power generation means, the rechargeable electronic watch comprising a watch circuit for counting or operating hour information or function information or the like and outputting information, a display means for displaying hour information or function information or the like based on output signal from the watch circuit, a power storage amount detecting means for detecting the power storage amount of the power storage means, a remaining capacity detecting means for detecting the remaining capacity of the accumulation means and a control means for controlling the operation of the watch circuit according to the energy balance of the remaining capacity, the power storage amount and the power consumption amount of the clock, wherein the watch circuit is driven by at least one clock operation mode selected from a plurality of clock operation modes different in power consumption provided by the watch circuit based on the control of the control means, and it is also possible to compose to comprise a power storage amount detecting means for detecting the power storage amount to the accumulation means, a power storage amount detecting means for detecting the power storage amount of the power storage means, and a control means for controlling the operation of the watch circuit according to the energy balance

of the power generation amount, the power storage amount and the power consumption amount of the clock, wherein the watch circuit is driven by at least one clock operation mode selected from a plurality of clock operation modes different in power consumption provided by the watch circuit based on the control of the control means.

As mentioned above, the control means according to the present invention is preferably composed to control to drive in a predetermined clock operation mode among a plurality of clock operation modes different in power consumption so that the energy balance would not be negative.

In other words, the clock operation mode is the one to stop at least a part of the display means, and the display means may be a hand, or the display means may be a digital display.

Briefly, the rechargeable electronic watch 10 according to the present invention is a rechargeable electronic watch operating with an energy source comprising a power supply including a power generation means and a power storage means charged with electric energy from the power generation means, wherein the watch circuit is driven by at least one clock operation mode selected from a plurality of clock operation modes different in power consumption provided by the watch circuit based on the control of the control means.

In the concrete example of the present invention, the operation modes in the user setting means by the user setting, namely the power saving means by the user setting are shown taking the relation shown in Table 3 as example; however, more concretely, cases as shown below can be supposed.

Namely, (1) not to inhibit display in any use state (user preference).

(2) Compel to display by pressing the button or the like, when liquid crystal display is inhibited, under the low power generation (for instance, when a rechargeable electronic watch driven by a solar cell is put in the dark).

(3) Set not to inhibit the alarm operation under any power generation amount.

(4) Inhibit to start the chronometric operation under the low power generation under, but not to inhibit the chronometric operation, once the same has started.

Concerning the setting of the user setting means in this concrete example, for instance,

1) regular setting (once set, valid until the cancellation)

2) temporary setting (valid only while the button is pressed)

states can be supposed.

Besides, in the power generation amount detecting means 30 according to the present invention, for instance, the following cases can be supposed concerning the detecting timing of the power generation amount detecting means 30, power generation amount level judgment, respective mode transition control according to the power generation amount,

1) confirm the clock operation mode based on the actual power generation amount, if a state of certain level of power generation has continued for a fixed period of time or more.

Such operation can limit the instant response to the power generation amount detecting, namely, inhibit an immediate transition to the power saving mode upon a momentary variation of power generation amount (for instance, when sunlight incident to a solar cell is shielded instantaneously by the sleeve).

2) The power generation amount level is judged by the integral value for a fixed time.

Such operation can limit the instant response to the power generation amount detecting for the same reason as 1), and increase the operation accuracy, in the balance judgment.

3) Sense the power generation amount intermittently.

Such operation reduces the current consumption of the power generation detecting itself.

4) Confirm the actual power generation amount, if a state in which the

power generation amount sensed in the 3) is of certain level continuously equal or superior to a fixed number of times.

Such operation can limit the instant response to the power generation amount detecting, and consequently, inhibit an immediate transition to the power saving mode upon a momentary variation of power generation amount (for instance, when sunlight incident to a solar cell is shielded instantaneously by the sleeve).

5) The transition between modes according to the power generation amount can be differentiated for the reducing power generation amount and for the increasing power generation amount. Namely, continuous detecting time or number of time required for level transition can be differentiated by the mode transition direction.

The feeling of use of the user can be improved, by making difficult to transit to the mode in the direction to limit the function, and easier to transit to the mode in the direction to cancel the function limitation, through such operation. In other words, it becomes possible to not to limit the function carelessly, and to cancel the function limitation promptly.

Another embodiment of the present invention is a driving method of a rechargeable electronic watch operating with an energy source comprising a power supply including a power generation means and a power storage means charged with electric energy from the power generation means, wherein the watch circuit is driven by at least one clock operation mode selected from a plurality of clock operation modes different in power consumption provided by the watch circuit, according to the power storage amount of the power storage means.

Another concrete example of the present invention is a driving method of a rechargeable electronic watch operating with an energy source comprising a power supply including a power generation means and a power storage means charged with electric energy from the power generation means, wherein the watch circuit is driven by at least one clock operation mode selected from a plurality

of clock operation modes different in power consumption provided by the watch circuit, according to the remaining capacity detecting means for detecting the remaining capacity of the power storage means, the remaining capacity and the power generation amount of the power generation means.

Still another concrete example of the present invention is a driving method of a rechargeable electronic watch operating with an energy source comprising a power supply including a power generation means and a power storage means charged with electric energy from the power generation means, wherein the watch circuit is driven by at least one clock operation mode selected from a plurality of clock operation modes different in power consumption provided by the watch circuit, according to the remaining capacity detecting means for detecting the remaining capacity of the power storage means, the remaining capacity and the power storage amount of the power storage means.

The rechargeable electronic watch and the driving method of the rechargeable electronic watch according to the present invention, adopting the technical composition mentioned above, is composed to optimize the electric power balance, by composing to adopt to select conveniently a clock operation mode according to the power generation amount of the power generation means and the power storage amount of the power storage means, in a ordinary rechargeable electronic watch displaying hour information or a multi-function type rechargeable electronic watch loaded with multiple functions providing many kinds of additional function information and, as the result, it becomes possible to extend the clock operation duration of the rechargeable electronic watch, and to provide a rechargeable electronic watch that would not affect the feeling of use of the rechargeable electronic watch, by limiting the limitation of functions user by the user to the strict minimum.

What is claimed is:

1. A rechargeable electronic watch operating with an energy source comprising a power supply including a power generation means and a power storage means charged with electric energy generated from said power generation means, said rechargeable electronic watch comprising a watch circuit for counting or processing time information or function information or the like so as to outputting said information, a display means for displaying said time information or said function information or the like based on an output signal from said watch circuit, a power generation amount detecting means for detecting an amount of said power generation of said power generation means, and a control means for controlling the operation of said watch circuit in response to said amount of said power generation , wherein said watch circuit is driven in at least one clock operation mode selected, based on the control of said control means, from a plurality of clock operation modes provided in said rechargeable electronic watch, each of said modes being different from each other in power consumption.

2. A rechargeable electronic watch operating with an energy source comprising a power supply including a power generation means and a power storage means charged with electric energy generated from said power generation means, said rechargeable electronic watch comprising a watch circuit for counting or processing time information or function information or the like so as to outputting said information, a display means for displaying said time information or said function information or the like based on an output signal from said watch circuit, a charge amount detecting means for detecting an amount of charge stored in said power storage means, and a control means for controlling the operation of said watch circuit in response to said amount of said charge, wherein said watch circuit is driven in at least one clock operation mode selected, based on the control of said control means, from a plurality of clock operation modes provided in said rechargeable electronic

watch, each of said modes being different from each other in power consumption.

3. A rechargeable electronic watch operating with an energy source comprising a power supply including a power generation means and a power storage means charged with electric energy generated from said power generation means, said rechargeable electronic watch comprising a watch circuit for counting or processing time information or function information or the like so as to outputting said information, a display means for displaying said time information or said function information or the like based on an output signal from said watch circuit, a power generation amount detecting means for detecting an amount of said power generation of said power generation means, a remaining capacity detecting means for detecting the remaining capacity of said power storage means and a control means for controlling the operation of said watch circuit in response to said remaining capacity and said amount of said power generation, wherein said watch circuit is driven in at least one clock operation mode selected, based on the control of said control means, from a plurality of clock operation modes provided in said rechargeable electronic watch, each of said modes being different from each other in power consumption.

4. A rechargeable electronic watch operating with an energy source comprising a power supply including a power generation means and a power storage means charged with electric energy generated from said power generation means, said rechargeable electronic watch comprising a watch circuit for counting or processing time information or function information or the like so as to outputting said information, a display means for displaying said time information or said function information or the like based on an output signal from said watch circuit, a charge amount detecting means for detecting an amount of charge stored in said power storage means, a remaining capacity detecting means for detecting the remaining capacity of said power storage means and a control means for controlling the operation of said watch circuit in response to said remaining capacity and said amount of said charge, and a control means

for controlling the operation of said watch circuit in response to said amount of said charge, wherein said watch circuit is driven in at least one clock operation mode selected, based on the control of said control means, from a plurality of clock operation modes provided in said rechargeable electronic watch, each of said modes being different from each other in power consumption.

5. A rechargeable electronic watch operating with an energy source comprising a power supply including a power generation means and a power storage means charged with electric energy generated from said power generation means, said rechargeable electronic watch comprising a watch circuit for counting or processing time information or function information or the like so as to outputting said information, a display means for displaying said time information or said function information or the like based on an output signal from said watch circuit, a power generation amount detecting means for detecting an amount of said power generation of said power generation means, a charge amount detecting means for detecting an amount of charge stored in said power storage means, and a control means for controlling the operation of said watch circuit in response to said amount of said power generation and said amount of said charge, wherein said watch circuit is driven in at least one clock operation mode selected, based on the control of said control means, from a plurality of clock operation modes provided in said rechargeable electronic watch, each of said modes being different from each other in power consumption.

6. The rechargeable electronic watch according to claim 1, 3 or 5, wherein, the lower said amount of said power generation is, said electronic watch is controlled to be driven under a clock operation mode whereby said electronic watch can be driven with the lesser power consumption and selected from a plurality of clock operation modes each being different from each other, in power consumption.

7. The rechargeable electronic watch according to claim 2, 4 or 5, wherein, the lower said amount of said charge is, said electronic watch is controlled to be

driven under a clock operation mode whereby said electronic watch can be driven with the lesser power consumption and selected from a plurality of clock operation modes each being different from each other, in power consumption.

8. The rechargeable electronic watch according to claim 3 or 4, wherein, the lower said remaining capacity is, said electronic watch is controlled to be driven under a clock operation mode whereby said electronic watch can be driven with the lesser power consumption and selected from a plurality of clock operation modes each being different from each other, in power consumption.

9. A rechargeable electronic watch operating with an energy source comprising a power supply including a power generation means and a power storage means charged with electric energy generated from said power generation means, said rechargeable electronic watch comprising a watch circuit for counting or processing time information or function information or the like so as to outputting said information, a display means for displaying said time information or said function information or the like based on an output signal from said watch circuit, a power generation amount detecting means for detecting an amount of said power generation of said power generation means, and a control means for controlling the operation of said watch circuit in response to an energy balance of said amount of said power generation and an amount of the power consumption of the rechargeable electronic watch, wherein said watch circuit is driven in at least one clock operation mode selected, based on the control of said control means, from a plurality of clock operation modes provided in said rechargeable electronic watch, each of said modes being different from each other in power consumption.

10. A rechargeable electronic watch operating with an energy source comprising a power supply including a power generation means and a power storage means charged with electric energy generated from said power generation means, said rechargeable electronic watch comprising a watch circuit for counting or processing time information or function information or the like so as to

outputting said information, a display means for displaying said time information or said function information or the like based on an output signal from said watch circuit, a charge amount detecting means for detecting an amount of charge stored in said power storage means, and a control means for controlling the operation of said watch circuit in response to an energy balance of said amount of said charge and an amount of the power consumption of the rechargeable electronic watch, wherein said watch circuit is driven in at least one clock operation mode selected, based on the control of said control means, from a plurality of clock operation modes provided in said rechargeable electronic watch, each of said modes being different from each other in power consumption.

11. A rechargeable electronic watch operating with an energy source comprising a power supply including a power generation means and a power storage means charged with electric energy generated from said power generation means, said rechargeable electronic watch comprising a watch circuit for counting or processing time information or function information or the like so as to outputting said information, a display means for displaying said time information or said function information or the like based on an output signal from said watch circuit, a power generation amount detecting means for detecting an amount of said power generation of said power generation means, a remaining capacity detecting means for detecting the remaining capacity of said power storage means and a control means for controlling the operation of said watch circuit in response to an energy balance of said amount of said power generation and an amount of said remaining capacity and an amount of the power consumption of the rechargeable electronic watch, wherein said watch circuit is driven in at least one clock operation mode selected, based on the control of said control means, from a plurality of clock operation modes provided in said rechargeable electronic watch, each of said modes being different from each other in power consumption.

12. A rechargeable electronic watch operating with an energy source comprising a power supply including a power generation means and a power storage means charged with electric energy generated from said power generation means, said rechargeable electronic watch comprising a watch circuit for counting or processing time information or function information or the like so as to outputting said information, a display means for displaying said time information or said function information or the like based on an output signal from said watch circuit, a charge amount detecting means for detecting an amount of charge stored in said power storage means, a remaining capacity detecting means for detecting the remaining capacity of said power storage means and a control means for controlling the operation of said watch circuit in response to an energy balance of said amount of said charge and an amount of said remaining capacity and an amount of the power consumption of the rechargeable electronic watch, wherein said watch circuit is driven in at least one clock operation mode selected, based on the control of said control means, from a plurality of clock operation modes provided in said rechargeable electronic watch, each of said modes being different from each other in power consumption.

13. A rechargeable electronic watch operating with an energy source comprising a power supply including a power generation means and a power storage means charged with electric energy generated from said power generation means, said rechargeable electronic watch comprising a watch circuit for counting or processing time information or function information or the like so as to outputting said information, a display means for displaying said time information or said function information or the like based on an output signal from said watch circuit, a power generation amount detecting means for detecting an amount of said power generation of said power generation means, a charge amount detecting means for detecting an amount of charge stored in said power storage means, and a control means for controlling the operation of said watch circuit in response to an energy balance of said amount of said charge

and an amount of said power generation and an amount of the power consumption of the rechargeable electronic watch, wherein said watch circuit is driven in at least one clock operation mode selected, based on the control of said control means, from a plurality of clock operation modes provided in said rechargeable electronic watch, each of said modes being different from each other in power consumption.

14. The rechargeable electronic watch according to any one of claims 9 to 13, wherein said control means drives said electronic watch at a predetermined clock operation mode selected from a plurality of clock operation modes each being different from each other, in power consumption, so that said energy balance may not be negative.

15. The rechargeable electronic watch according to any one of claims 1 to 5 and 9 to 13, wherein under said clock operation mode, at least a part of said display means is stopped.

16. The rechargeable electronic watch according to claim 14, wherein under said clock operation mode, at least a part of said display means is stopped.

17. The rechargeable electronic watch according to claim 6, wherein under said clock operation mode, at least a part of said display means is stopped.

18. The rechargeable electronic watch according to claim 7, wherein under said clock operation mode, at least a part of said display means is stopped.

19. The rechargeable electronic watch according to claim 8, wherein under said clock operation mode, at least a part of said display means is stopped.

20. The rechargeable electronic watch of claim 15, wherein said display means comprises a clock hand.

21. The rechargeable electronic watch of claim 15, wherein said display means is a digital display.

22. The rechargeable electronic watch according to any one of claims 1 to 5 and 9 to 13, wherein said electronic watch further comprising an user setting means allowing the user to set said clock operation mode, wherein said control means

drives the watch circuit at the user's desired clock operation mode, based on an output signal from said user setting means.

23. A driving method of a rechargeable electronic watch operating with an energy source comprising a power supply including a power generation means and a power storage means charged with electric energy generated from said power generation means, said rechargeable electronic watch is driven in at least one clock operation mode selected from a plurality of clock operation modes provided in said rechargeable electronic watch, each of said modes being different from each other in power consumption, in response to said amount of said power generation.

24. A driving method of a rechargeable electronic watch operating with an energy source comprising a power supply including a power generation means and a power storage means charged with electric energy generated from said power generation means, wherein said rechargeable electronic watch is driven in at least one clock operation mode selected from a plurality of clock operation modes provided in said rechargeable electronic watch, each of said modes being different from each other in power consumption, in response to an amount of charge stored in said power storage means.

25. A driving method of a rechargeable electronic watch operating with an energy source comprising a power supply including a power generation means and a power storage means charged with electric energy generated from said power generation means, wherein said rechargeable electronic watch is driven in at least one clock operation mode selected from a plurality of clock operation modes provided in said rechargeable electronic watch, each of said modes being different from each other in power consumption, in response to a remaining capacity of said power storage means detected by a remaining capacity detecting means and said amount of said power generation of said power generation means.

26. A driving method of a rechargeable electronic watch operating with an energy source comprising a power supply including a power generation means and

a power storage means charged with electric energy generated from said power generation means, wherein said rechargeable electronic watch is driven in at least one clock operation mode selected from a plurality of clock operation modes provided in said rechargeable electronic watch, each of said modes being different from each other in power consumption, in response to a remaining capacity of said power storage means detected by a remaining capacity detecting means and an amount of charge stored in said power storage means.

ABSTRACT OF THE DISCLOSURE

To extend the clock operation duration of a multi-functional rechargeable electronic watch, and to provide a rechargeable electronic watch that would not affect the feeling of use of said rechargeable electronic watch.

A rechargeable electronic watch (10) operating with an energy source comprising a power supply (26) including a power generation means (1) and a power storage means (2) charged with electric energy from said power generation means (1), said rechargeable electronic watch comprising a watch circuit (5) for counting or operating hour information or function information or the like and outputting information, a display means (11) for displaying hour information or function information or the like based on output signal from said watch circuit, a power generation volume detecting means (3) for detecting the power generation volume of said power generation means (1), and a control means (5) for controlling the operation of said watch circuit (5) according to said power generation volume, wherein said watch circuit (5) is driven by at least one clock operation mode selected from a plurality of clock operation modes different in power consumption provided by said watch circuit (5).

Fig. 1

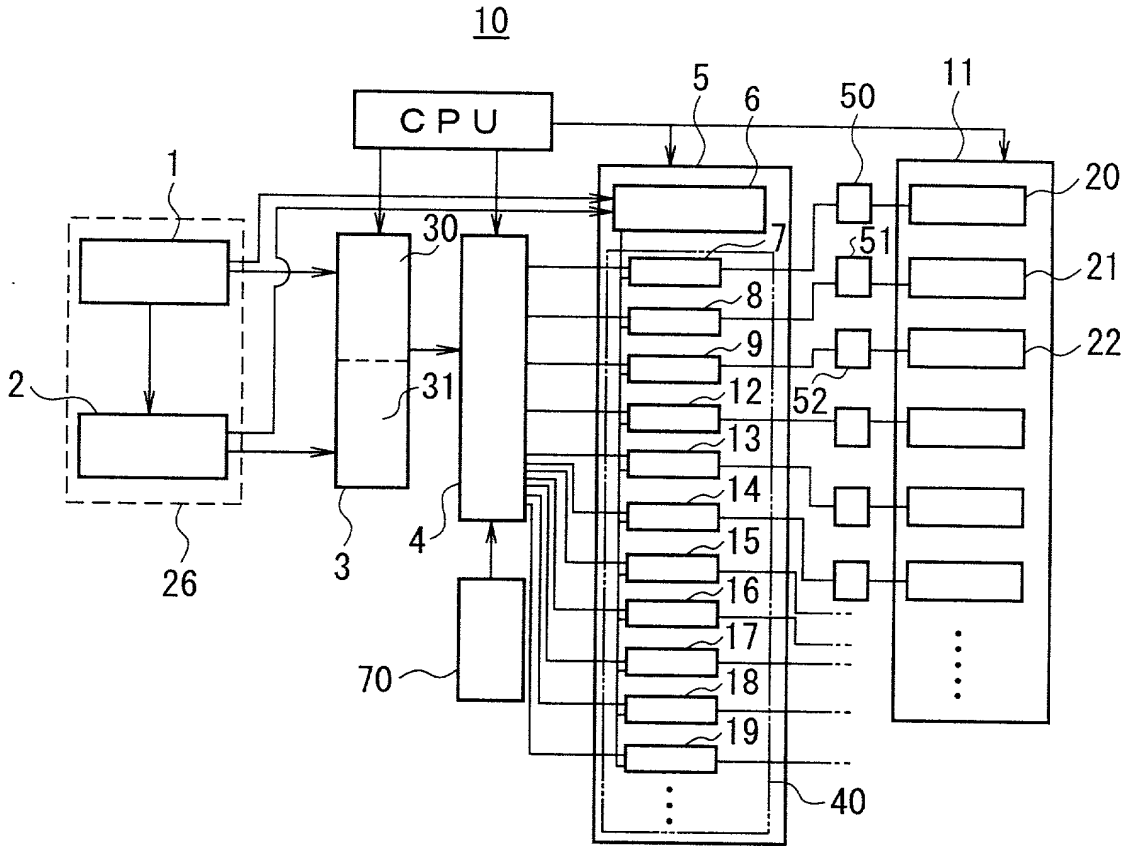

10
CPU
1
2
26
3
30
31
4
70
5
6
7
8
9
12
13
14
15
16
17
18
19
40
50
51
52
11
20
21
22

Fig. 2

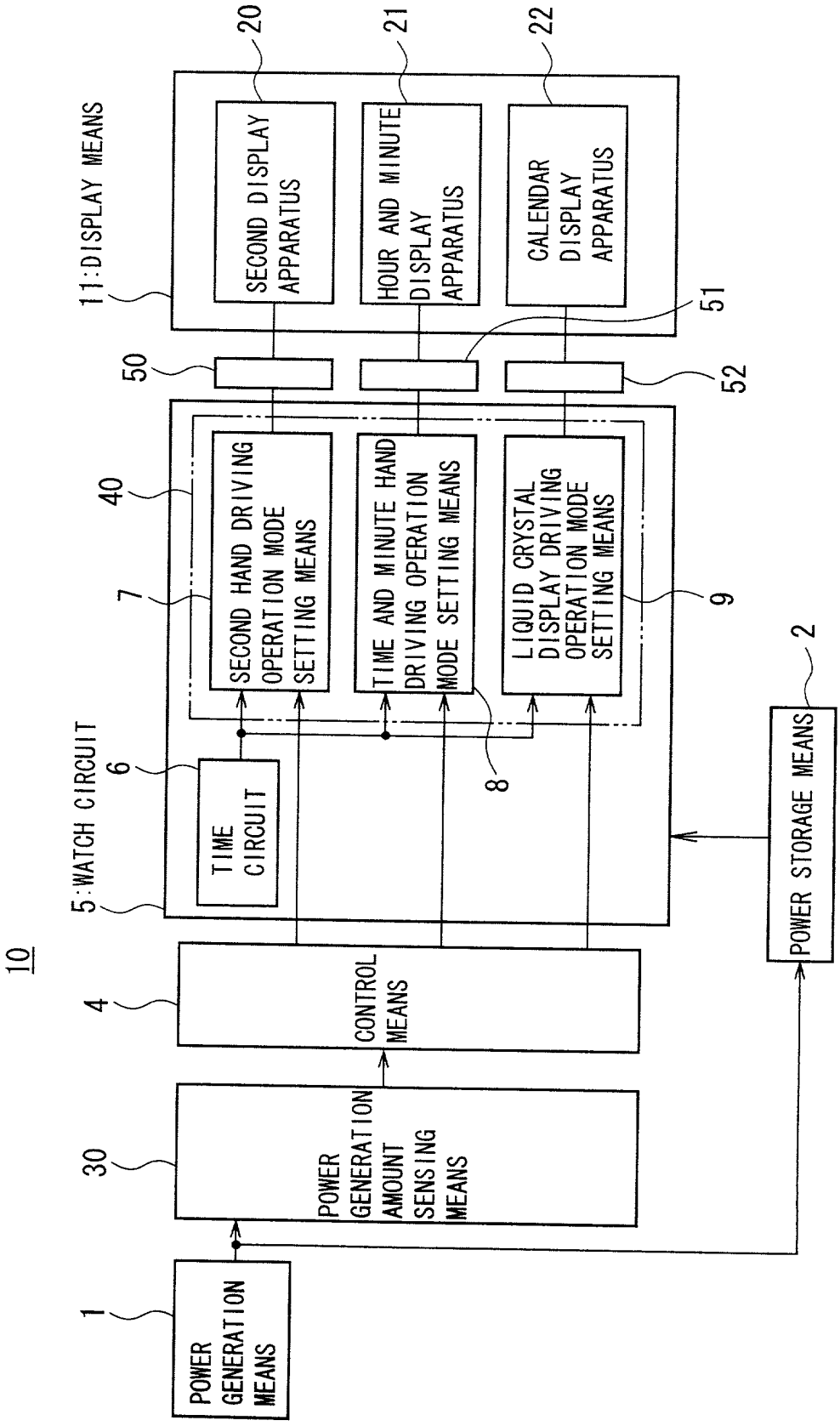

10
1
POWER GENERATION MEANS
30
POWER GENERATION AMOUNT SENSING MEANS
4
CONTROL MEANS
5:WATCH CIRCUIT
6
TIME CIRCUIT
7
40
SECOND HAND DRIVING OPERATION MODE SETTING MEANS
8
TIME AND MINUTE HAND DRIVING OPERATION MODE SETTING MEANS
9
LIQUID CRYSTAL DISPLAY DRIVING OPERATION MODE SETTING MEANS
50
51
52
11:DISPLAY MEANS
20
SECOND DISPLAY APPARATUS
21
HOUR AND MINUTE DISPLAY APPARATUS
22
CALENDAR DISPLAY APPARATUS
2
POWER STORAGE MEANS

Fig. 3

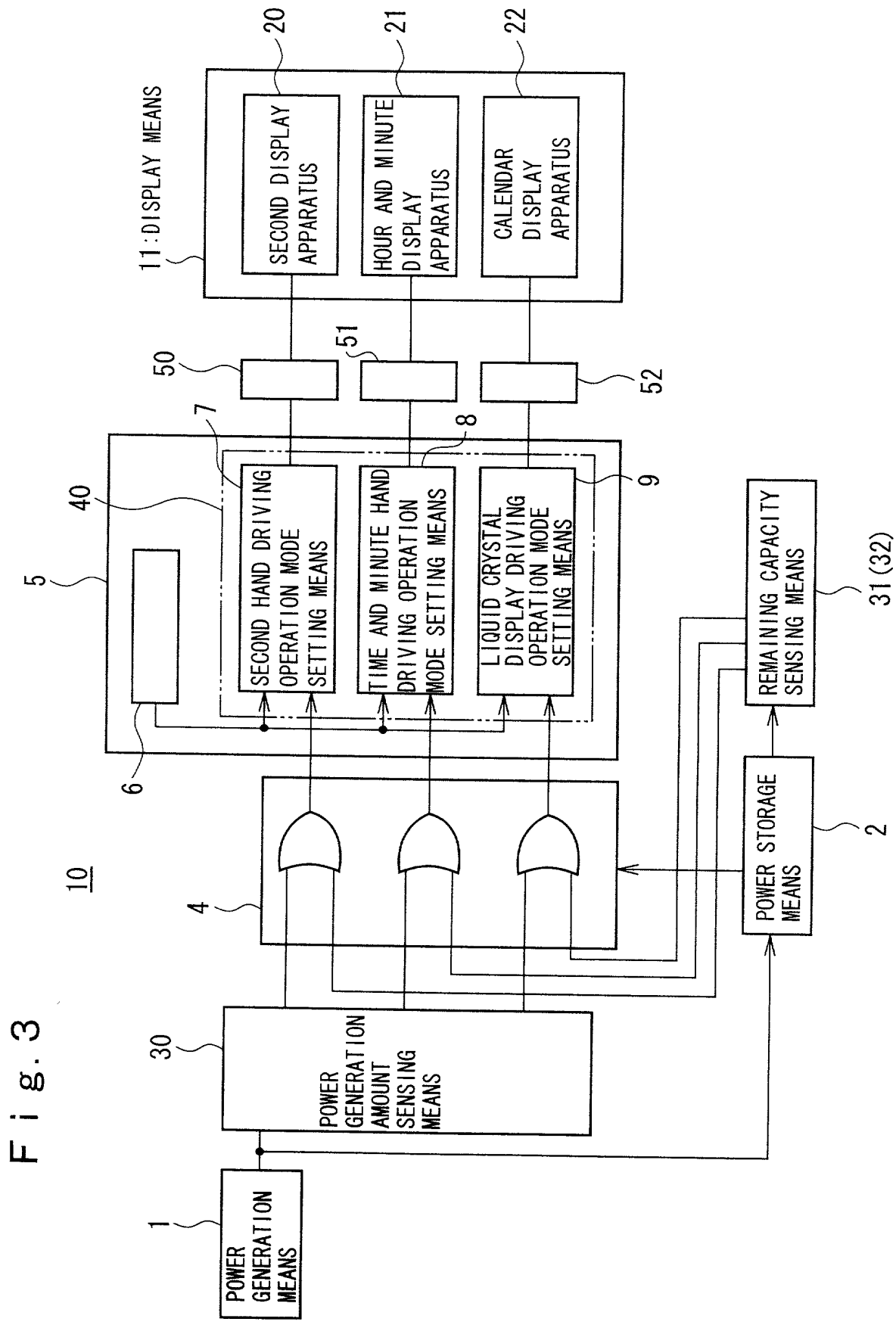

10
1
POWER GENERATION MEANS
30
POWER GENERATION AMOUNT SENSING MEANS
4
6
5
40
7
SECOND HAND DRIVING OPERATION MODE SETTING MEANS
8
TIME AND MINUTE HAND DRIVING OPERATION MODE SETTING MEANS
9
LIQUID CRYSTAL DISPLAY DRIVING OPERATION MODE SETTING MEANS
50
51
52
11:DISPLAY MEANS
20
SECOND DISPLAY APPARATUS
21
HOUR AND MINUTE DISPLAY APPARATUS
22
CALENDAR DISPLAY APPARATUS
2
POWER STORAGE MEANS
31(32)
REMAINING CAPACITY SENSING MEANS

Fig. 4

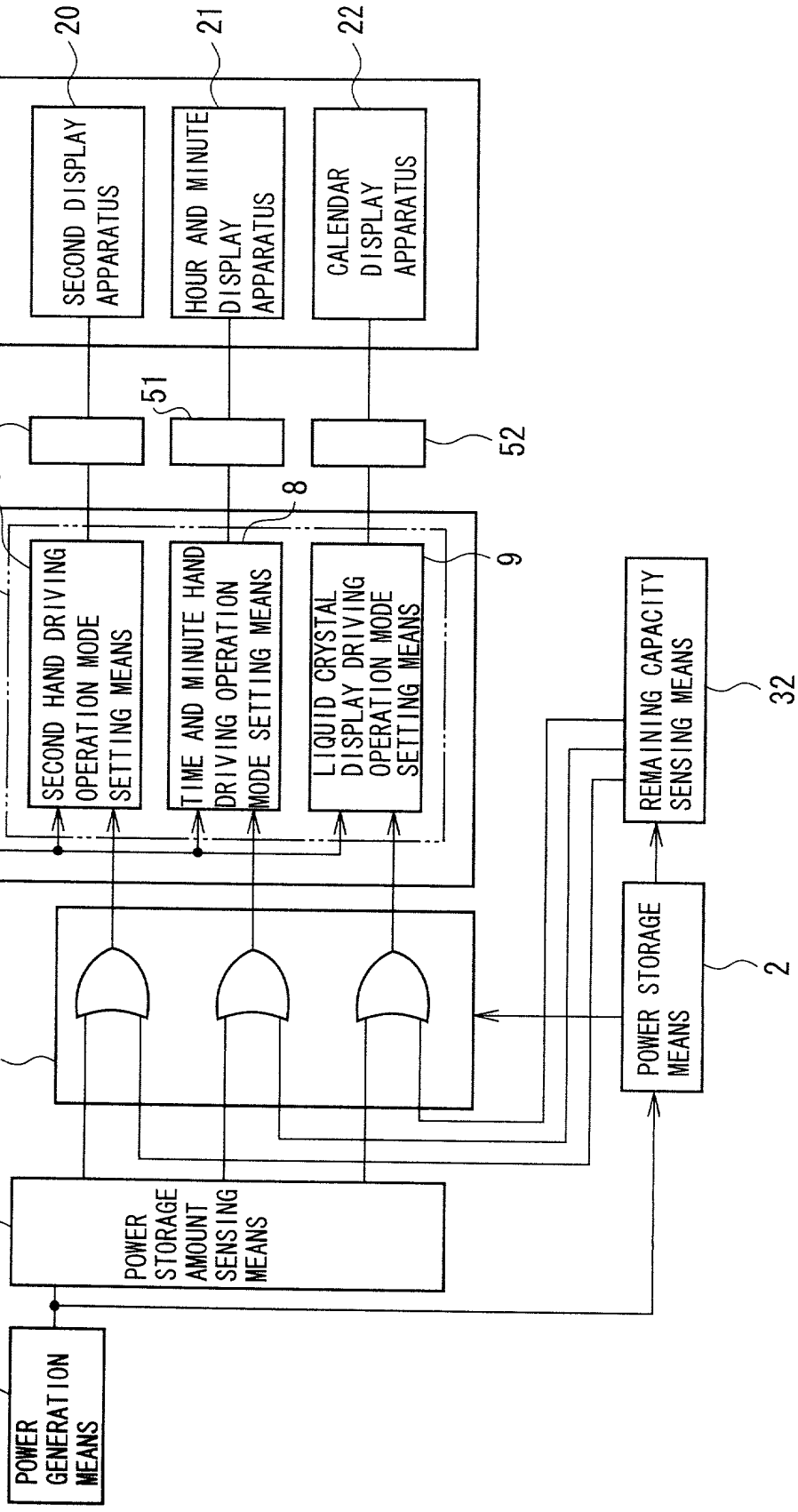
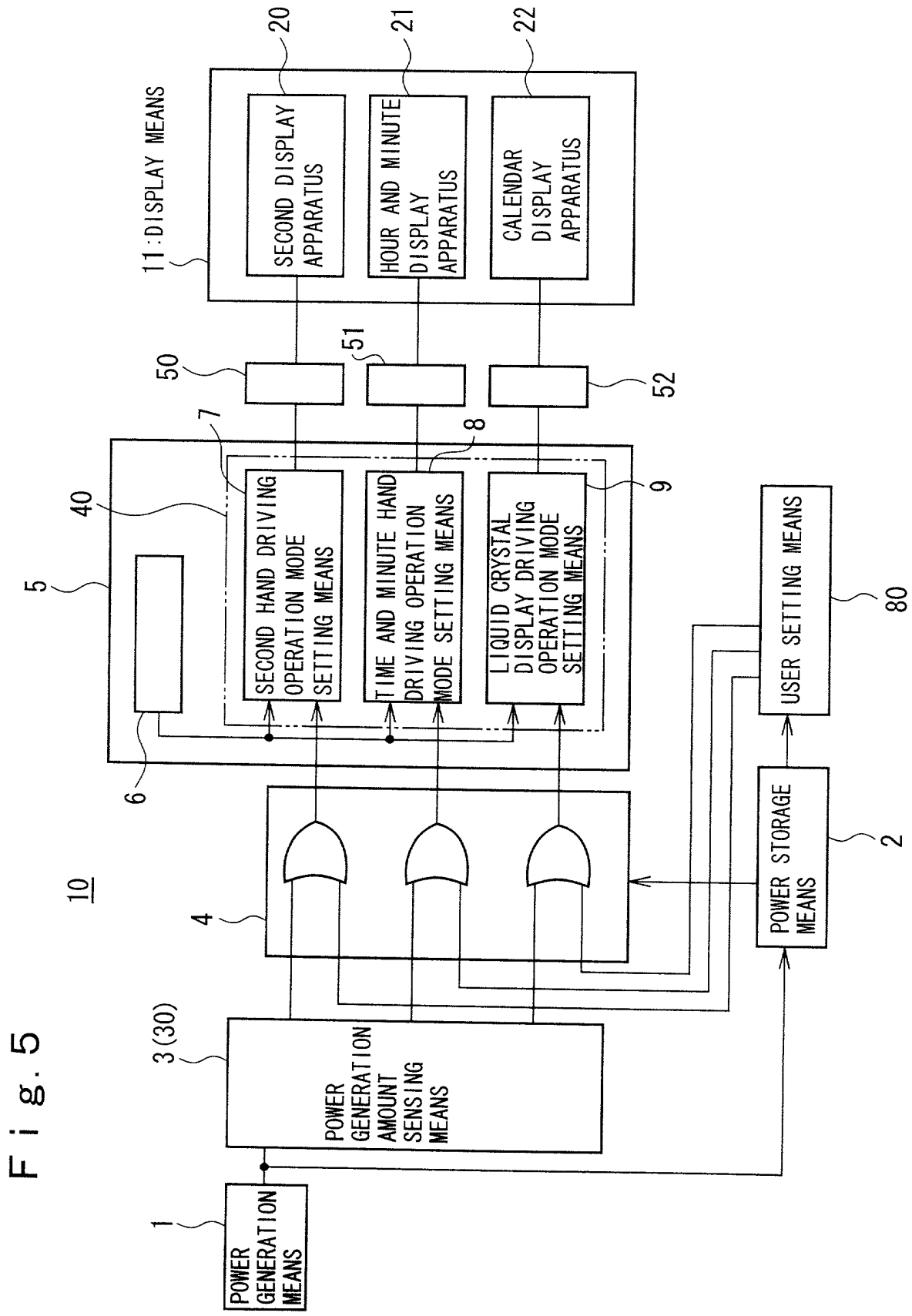

10
1
POWER GENERATION MEANS
31
POWER STORAGE AMOUNT SENSING MEANS
4
5
6
40
7
SECOND HAND DRIVING OPERATION MODE SETTING MEANS
8
TIME AND MINUTE HAND DRIVING OPERATION MODE SETTING MEANS
9
LIQUID CRYSTAL DISPLAY DRIVING OPERATION MODE SETTING MEANS
50
51
52
11:DISPLAY MEANS
20
SECOND DISPLAY APPARATUS
21
HOUR AND MINUTE DISPLAY APPARATUS
22
CALENDAR DISPLAY APPARATUS
2
POWER STORAGE MEANS
32
REMAINING CAPACITY SENSING MEANS

Fig. 5


10
1
POWER GENERATION MEANS
3(30)
POWER GENERATION AMOUNT SENSING MEANS
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POWER STORAGE MEANS
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USER SETTING MEANS
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SECOND HAND DRIVING OPERATION MODE SETTING MEANS
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9
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SECOND DISPLAY APPARATUS
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HOUR AND MINUTE DISPLAY APPARATUS
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CALENDAR DISPLAY APPARATUS

TABLE 1

POWER GENERATION AMOUNT	CONTROL SIGNAL			OPERATION MODE
	Ea	Eb	Ec	
HIGH	H	H	H	CALENDAR DISPLAY + SECOND DISPLAY + HOUR AND MINUTE DISPLAY
|	L	H	H	SECOND DISPLAY + HOUR AND MINUTE DISPLAY
|	L	L	H	HOUR AND MINUTE DISPLAY
LOW	L	L	L	NO DISPLAY

TABLE 2

		REMAINING CAPACITY			
		HIGH ——— LOW			
	CONTROL SIGNAL BECOMING H	Ma, Mb, Mc	Mb, Mc	Mc	NONE
POWER GENERATION AMOUNT HIGH	Ea, Eb, Ec	LC+SEC+H/MIN	LC+SEC+H/MIN	LC+SEC+H/MIN	LC+SEC+H/MIN
|	Eb, Ec	LC+SEC+H/MIN	SEC+H/MIN	SEC+H/MIN	SEC+H/MIN
|	Ec	LC+SEC+H/MIN	SEC+H/MIN	HOUR/MIN	HOUR/MIN
LOW	NONE	LC+SEC+H/MIN	SEC+H/MIN	HOUR/MIN	NONE

TABLE 3

			USER SETTING STATE			
			ALWAYS DISPLAY ALL	LIMIT LIQUID CRYSTAL DISPLAY ACCORDING TO POWER GENERATION AMOUNT Sa	LIMIT LIQUID CRYSTAL, AND SECOND DISPLAY ACCORDING TO POWER GENERATION AMOUNT Sa, Sb	LIMIT LIQUID CRYSTAL, SECOND, HOUR/MIN DISPLAY ACCORDING TO POWER GENERATION AMOUNT Sa, Sb, Sc
		CONTROL SIGNAL BECOMING H	Ma, Mb, Mc	Mb, Mc	Mc	NONE
POWER GENERATION AMOUNT	HIGH	Ea, Eb, Ec	LC+SEC+H/MIN	LC+SEC+H/MIN	LC+SEC+H/MIN	LC+SEC+H/MIN
		Eb, Ec	LC+SEC+H/MIN	SEC+H/MIN	SEC+H/MIN	SEC+H/MIN
		Ec	LC+SEC+H/MIN	SEC+H/MIN	HOUR/MIN	HOUR/MIN
	LOW	NONE	LC+SEC+H/MIN	SEC+H/MIN	HOUR/MIN	NONE

TABLE 4

POWER GENERATION AMOUNT	BALANCE RELATION	OPERATION MODE
HIGH	$IG \geqq Ia+Ib+Ic+Iz$	LC DISPLAY + SECOND DRIVE + H/MIN DRIVE + CLOCK CIRCUIT
	$Ia+Ib+Ic+Iz > IG \geqq Ib+Ic+Iz$	SECOND DRIVE + H/MIN DRIVE + CLOCK CIRCUIT
	$Ib+Ic+Iz > IG \geqq Ic+Iz$	HOUR/MIN DRIVE + CLOCK CIRCUIT
	$Ic+Iz > IG \geqq Iz$	CLOCK CIRCUIT
LOW	$Iz > IG$	STOP ALL CIRCUITS

Docket No.
14092

Declaration and Power of Attorney For Patent Application

English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

RECHARGEABLE ELECTRONIC WATCH AND DRIVING METHOD OF RECHARGEABLE ELECTRONIC WATCH

the specification of which

(check one)

- ☒ is attached hereto.
- ☐ was filed on _____ as United States Application No. or PCT International Application Number _____
- and was amended on _____ (if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)			Priority Not Claimed
11-333051	Japan	24/11/1999	☐
(Number)	(Country)	(Day/Month/Year Filed)	
			☐
(Number)	(Country)	(Day/Month/Year Filed)	
			☐
(Number)	(Country)	(Day/Month/Year Filed)	

I hereby claim the benefit under 35 U.S.C. Section 119(e) of any United States provisional application(s) listed below:

(Application Serial No.)	(Filing Date)
(Application Serial No.)	(Filing Date)
(Application Serial No.)	(Filing Date)

I hereby claim the benefit under 35 U. S. C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112. I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C. F. R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

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